# *Quantitative Trait Loci (QTL) Mapping of Resistance to Gray Leaf Spot in* Lolium

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**Objectives:**

1. To generate populations by crosses of resistant clones (from the MFA x MFB and L4B-5 x MF-8 populations) with resistant plants to be selected from commercial perennial ryegrass cultivars and breeding lines including 'Paragon GLR', 'Gray Star', 'Gray Fox', 'Grey Goose', 'Manhattan-5', 2COL-07, and 2NKM-1.
2. To develop perennial ryegrass plants having a broad spectrum of GLS resistance by pyramiding multiple resistant genes originated from various sources of *Lolium* species and cultivars.

**Start Date:** 2003
**Project Duration:** three years
**Total Funding**: $87,883

Despite the fact that perennial ryegrass (*Lolium perenne*) is a valuable cool-season turfgrass, gray leaf spot caused by *Magnaporthe grisea* has become a serious problem on perennial ryegrass fairways on golf courses. Under favorable environmental conditions, gray leaf spot (GLS) can completely destroy ryegrass stands in a short period of time.

The use of host resistance is an environmentally sound method to control gray leaf spot which has been well studied and utilized in other hosts (mainly rice) of *M. grisea*. With the use of recently improved perennial ryegrass cultivars ('Paragon GLR', 'Palmer GLS', 'Panther GLS', 'SR 4600', 'Protégé', 'Gray Star', 'Gray Fox', 'Gray Goose', and' Manhattan 5') with resistance to gray leaf spot, there has been some concern that those resistant cultivars might break down due to selection of pathogen isolates that can overcome the resistance genes. Research on interaction between pathogen variability and host resistance in perennial ryegrass needs immediate attention.

Previously detected GLS-resistant QTLs in MFA and MFB plants are related with partial resistance. The combination of partial resistance has proven to be more durable to attacks by different GLS pathogen races and so is likely to last longer than race-specific resistance. To evaluate interaction between pathogen variability and host resistance in GLS disease, two ryegrass mapping parent clones (MFA, MFB), five commercial resistant cultivars, 'Paragon GLR' (two selected GLS-resistant, Paragon-1R, Paragon-2R and susceptible plants, Paragon-3S and Paragon-4S based on the previous inoculation experiment), 'Gray Star', 'Gray Fox', 'Grey Goose', 'Manhattan 5' (obtained from Dr. Stacy Bonos, Rutgers University and commercial turfgrass seed companies), and two breeding lines, 2COL-07 and 2NKM-1 (from seed company) were inoculated using twelve perennial ryegrass and one rice isolates. The isolates were: GG9, GG11, GG12 (Dr. M. Farman, Univ. of Kentucky), BL00, LP97, Lin00 (Dr. A. Hamblin, Univ. of Illinois), 6082 (Dr. S. Leong, Univ. of Wisconsin), 05T-04, 02V-23.1, 04S-01, 06T-02, 11W-03, and 11W-07 (Dr. W. Uddin, Penn. State Univ.).

*QTL mapping for gray leaf spot resistance is essential in developing resistant (left) versus susceptible (right) perennial ryegrass cultivars.*

The ryegrass plants were grown in French Hall greenhouse at University of Massachusetts-Amherst and then inoculated with the isolates under growth chamber conditions. As previously evaluated, MFA and MFB were resistant to all those isolates and Paragon-3S and Paragon-4S were very susceptible as expected. All commercial cultivars and experimental lines tested were highly resistant to the isolates but 2NKM-1 and 'Gray Star' were moderately resistant. A marginal significant interaction between isolates and genotypes was observed, but more inoculation experiments are required to confirm the result.

The results encourage further investigation. Some individual plants (5-10) will be randomly selected from those resistant cultivars and breeding lines in order to test whether there is any significant interaction between pathogen variability and host resistance of different sources. Further inoculations using clonally replicated plants and 13 geographically diverse isolates will be performed to check whether the resistance in commercial cultivars differs from ones in MFA and MFB.

If pathogen variability does have a significant interaction with host resistance, crosses will combine different sources of resistance genes so that the genetic basis of gray leaf spot resistance can be improved in perennial ryegrass. Further, DNA markers significantly associated with QTLs for GLS resistances of various sources will be developed for marker-assisted selection. Multiple disease resistance genes will be incorporated into an elite perennial ryegrass cultivar which will increase the use of host resistance as an integrated pest management strategy for turfgrass managers.

## Summary Points

- Significant difference in pathogenicity among 13 gray leaf spot (GG9, GG11, GG12, BL00, LP97, Lin00, 05T-04, 02V-23.1, 04S-01, 06T-02, 11W-03, and 11W-07) and one rice (6082) isolates under the controlled greenhouse conditions.
- Seven perennial ryegrass cultivars and breeding lines with improvement of GLS resistance showed a high level of resistance to the 13 geographically diverse isolates, which might indicate race non-specific resistance in perennial ryegrass.
- Preliminary results indicated a marginally significant interaction between gray leaf spot isolates and ryegrass germplasms under controlled greenhouse conditions. However, more inoculation experiments at single individual plant rather than a cultivar of mixed genotypes are needed to confirm the finding.